Model Database Interface

(MDBI)

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&

Applying User-developed Climate Analytics as a web-service

GFDL SUMMER SCHOOL 2012

GOALS FOR THE SESSION

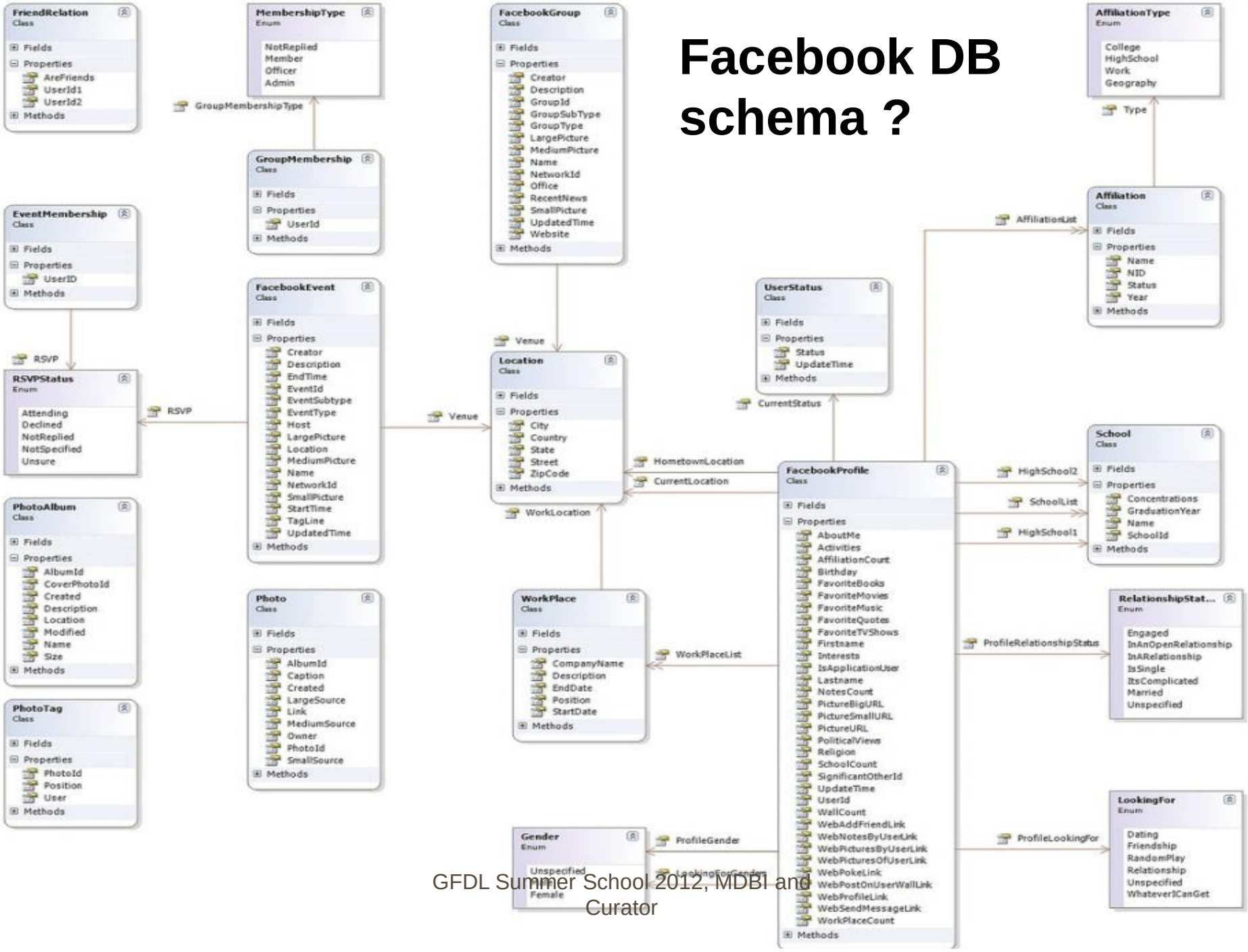
1. Model Database Interface (MDBI) –
   a) what is it? Where is it?
   b) Learning to navigate to different experiments and lookup for information on GFDL experiments from the MDBI.
   (Some features will be demonstrated)

1.1. Class work/Exercise -1
   a) Try a couple of features of MDBI in class

2. Applying user-developed climate analytics on CMIP5 datasets
   a) What is it?

2.1. Class work /Exercise-2
   a) Apply time-averaged spectrum climate analysis on a pool of CMIP5 datasets

Facebook DB schema ?



CURATOR MODEL DATABASE

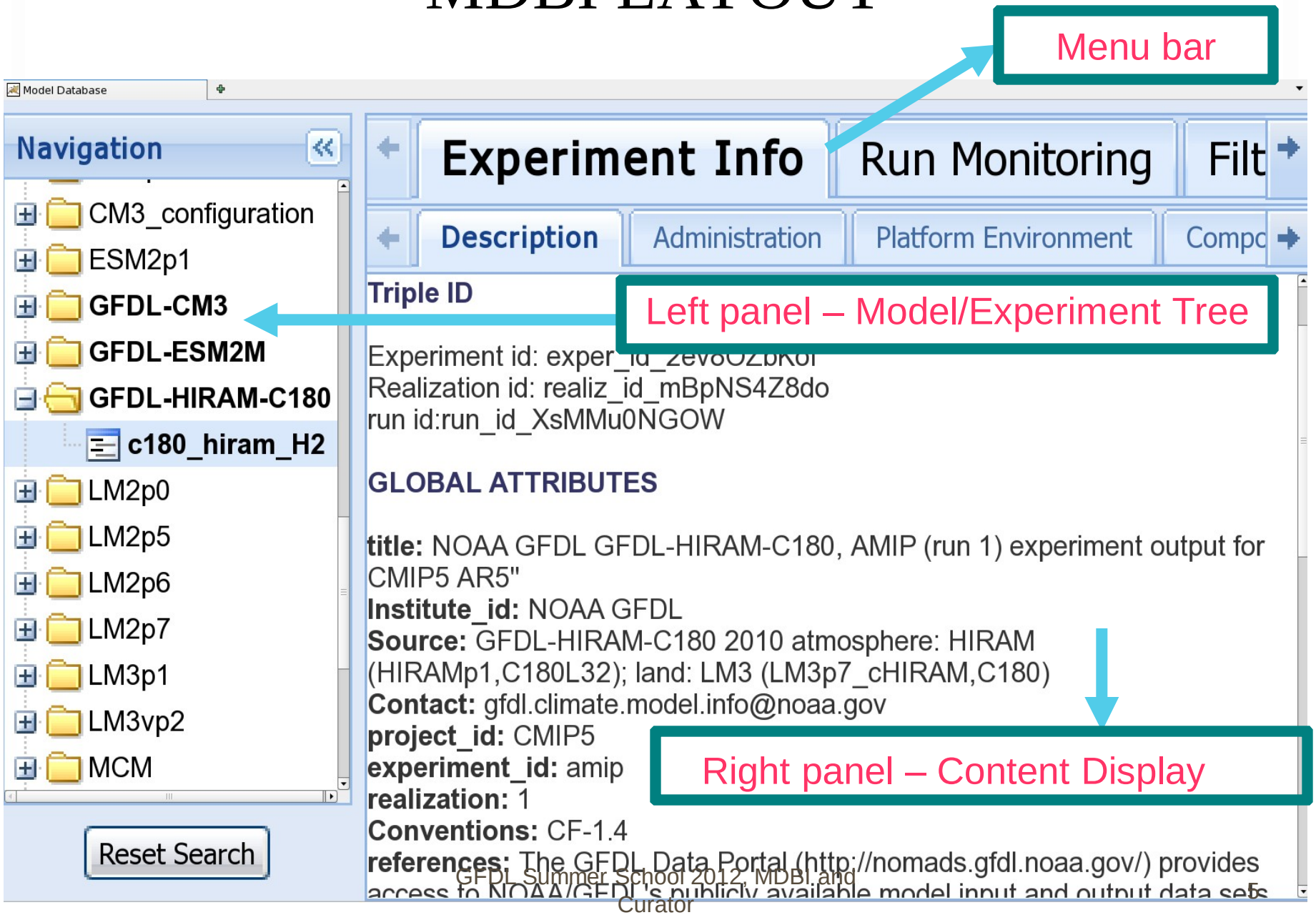
GFDL experiments metadata

GFDL climate Field metadata

CMIP5/ACCMIP Variable mappings

Etc etc..

MDBI LAYOUT


Menu bar
Model Database
Navigation
Experiment Info
Run Monitoring
Filt
Description
Administration
Platform Environment
Compo
CM3_configuration
ESM2p1
GFDL-CM3
GFDL-ESM2M
GFDL-HIRAM-C180
c180_hiram_H2
LM2p0
LM2p5
LM2p6
LM2p7
LM3p1
LM3vp2
MCM
Reset Search
Left panel – Model/Experiment Tree
Triple ID
Realization id: realiz_id_mBpNS4Z8do
run id:run_id_XsMMu0NGOW
GLOBAL ATTRIBUTES
title: NOAA GFDL GFDL-HIRAM-C180, AMIP (run 1) experiment output for CMIP5 AR5"
Institute_id: NOAA GFDL
Source: GFDL-HIRAM-C180 2010 atmosphere: HIRAM (HIRAMp1,C180L32); land: LM3 (LM3p7_cHIRAM,C180)
Contact: gfdl.climate.model.info@noaa.gov
project_id: CMIP5
experiment_id: amip
realization: 1
Conventions: CF-1.4
Right panel – Content Display

DEMO WITH USE-CASES

Where is this MDBI??!

http://cobweb.gfdl.noaa.gov:8080/extmdbCW

(Open this url in your Firefox web browser)

DEMO WITH USE-CASES CONTD..

Can I get a brief description of any experiment On MDBI?

Yes, please select an experiment and Click on the Description tab under the Experiment Info tab

DEMO WITH USE-CASES. CONTD..

When and by whom was this Experiment checked into the Database?

Please select the experiment you're Interested in and go to Experiment Info tab at the top-level, and Administration tab at the bottom-level.

DEMO WITH USE-CASES. CONTD..

What about the Runtime Settings
For an experiment?
Can I find them on MDBI?

Sure, please select an experiment and click on the tab
“Run Descriptions” -
to get the runtime settings defined for a particular experiment.

DEMO WITH USE-CASES. CONTD..

How can I find the Coupler Diag and NML-coupler info?

Please select an experiment and Click on the Component Configuration tab under Experiment Info

DEMO WITH USE-CASES. CONTD..

How can I find the INPUT FILES-
Diag tables/
Datafile/namelists
defined for this experiment?

Please select an experiment and
Click on the INPUT FILES tab under
Experiment Info

DEMO WITH USE-CASES. CONTD..

What variables were defined in the Postprocess section of the XML?

Please select an experiment and Click on the “Post Processing” tab under Experiment Info tab.

DEMO WITH USE-CASES. CONTD..

I think I need to look at the XML for this Experiment. Where is it?

Please click on “Generate XML” tab on MDBI and then
choose the experiment that you're Interested in.
Clicking on “View Original XML”
Will open up the XML in a new window.

DEMO WITH USE-CASES. CONTD..

Where can I find the procedures to Checkout an experiment's code?

Please select an experiment and click on the tab “Checkout procedures” - Under experiment info tab

DEMO WITH USE-CASES

I ran frepp yesterday on experiment A.
Is there a way to tell if all the postprocess Output files are available already?

Yes. Please click on the top-level

Tab named “Monitoring” , and then

“PP monitoring” in the lower level tab.

Now, select the experiment you'd like to monitor.

DEMO WITH USE-CASES (last use-case!)

Ok.. where can I find the files/figures that
I post-processed?

Please select an experiment and
Click on the “PP Directory” tab under
Experiment Info tab.

End of Part-1

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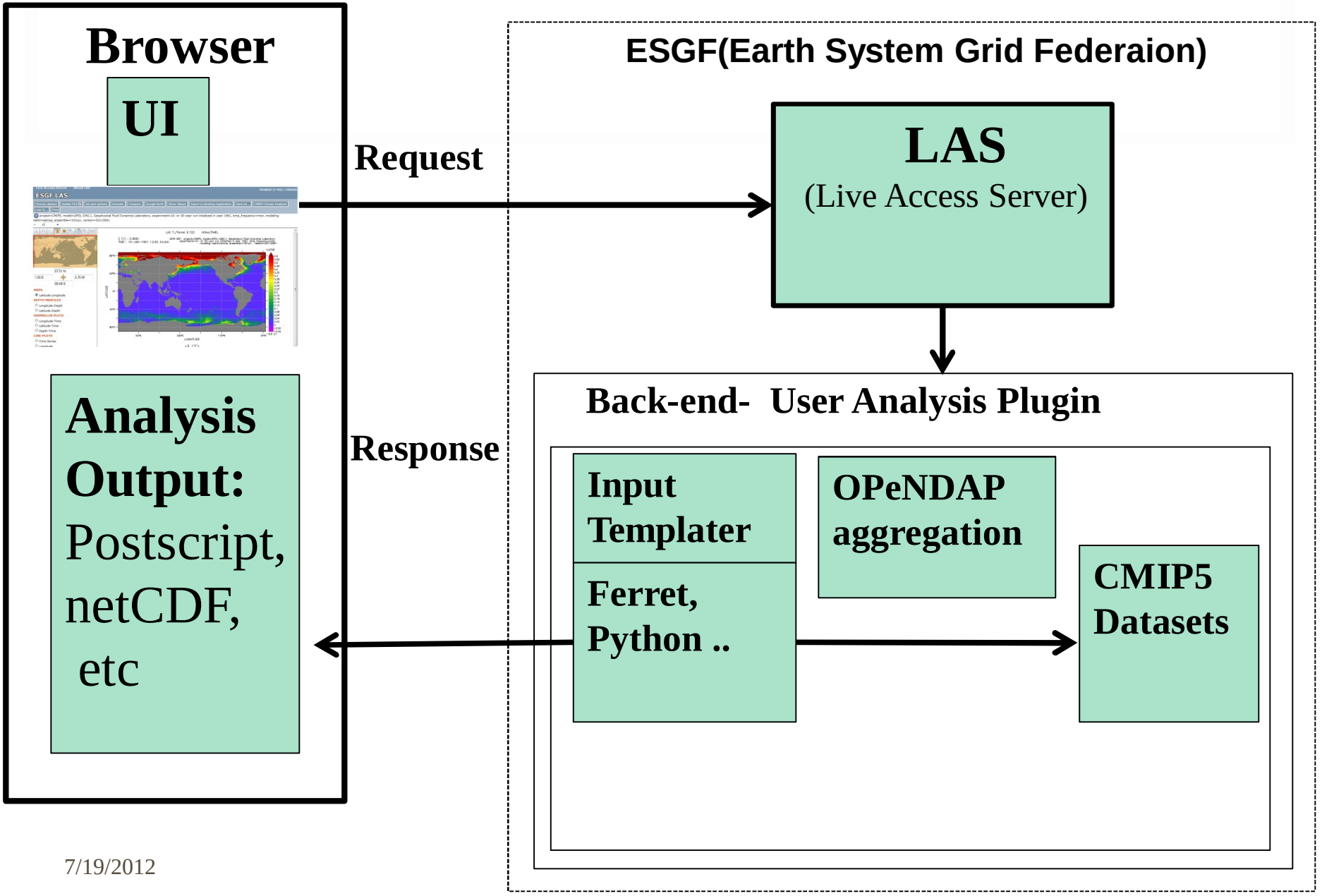
Applying User-developed Climate Analytics as a web-service

Aparna Radhakrishnan[1], Balaji Venkataramani[2]

GFDL SUMMER SCHOOL 2012

LAS-User-analysis Webservice Architecture



Templater Script – (from yesterday's frepp talk)

The template script contains variables to be filled by frepp, ie:

set in_data_dir #pp directory containing files to be analyzed

set in_data_file #list of all filenames to be analyzed

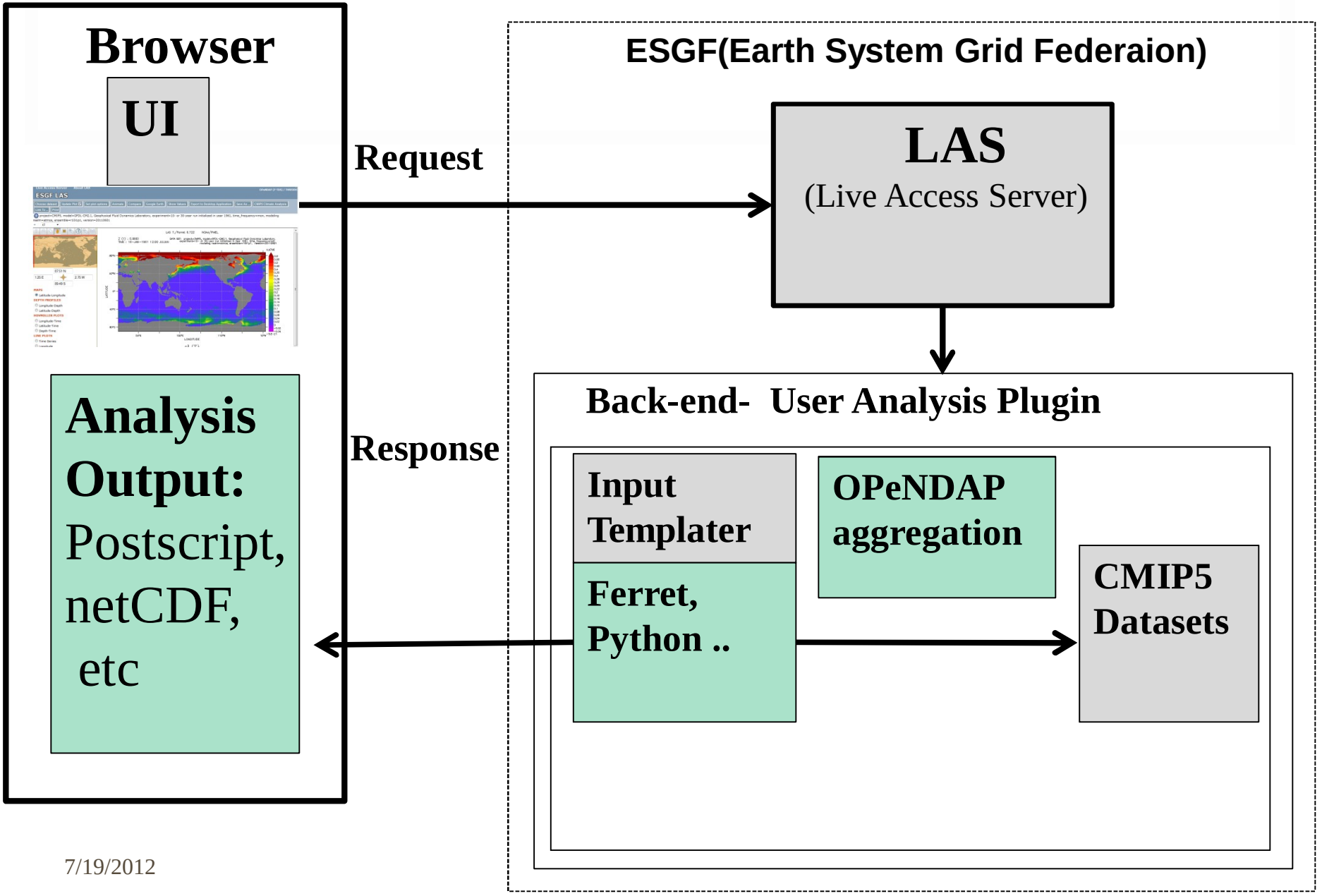
set descriptor #experiment name

set out_dir #directory to write output files

set yr1 #first year to analyze

set yr2 #last year to analyze

LAS-User-analysis Webservice Architecture



OPeNDAP aggregations

- OPeNDAP provides software which makes local data accessible to remote locations regardless of local storage format.
- The data provider wants to group together a collection of DAP URLs so that they can also function as a single URL. This will enable data sets made up of many files to appear as a single entity.

Ref: www.opendap.org

OPeNDAP aggregations (contd..)

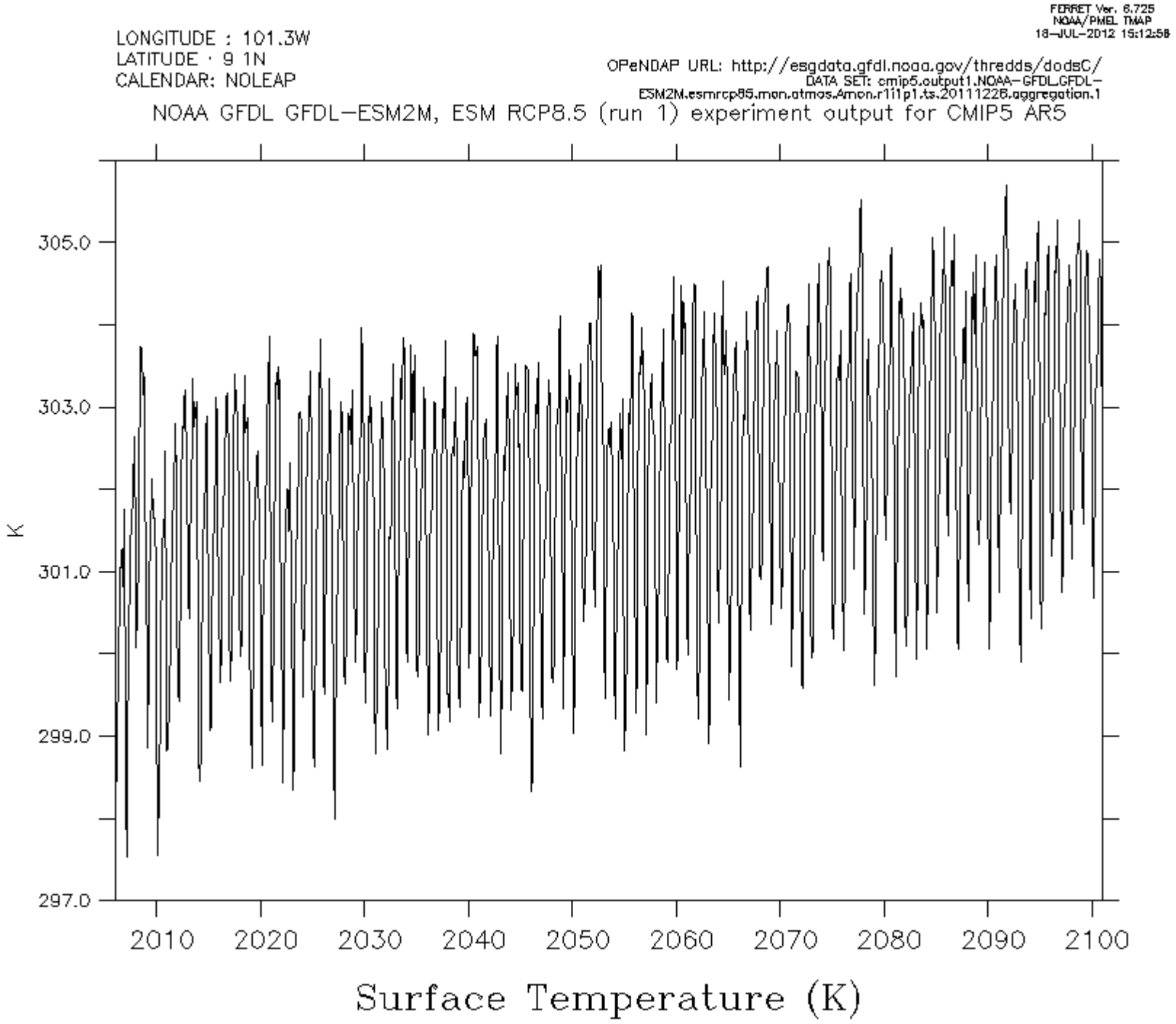
yes? sh da

currently SET data sets:

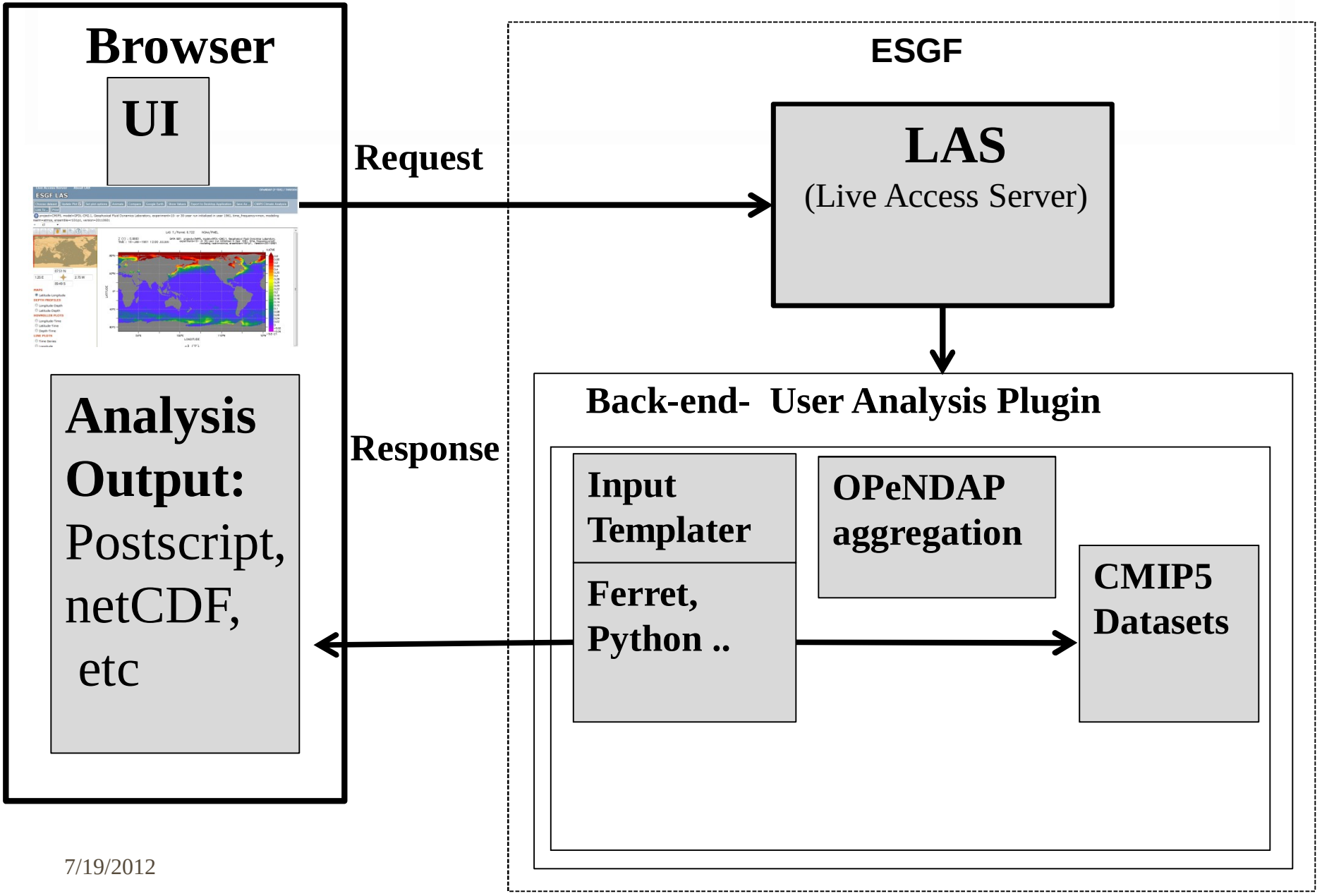
1>

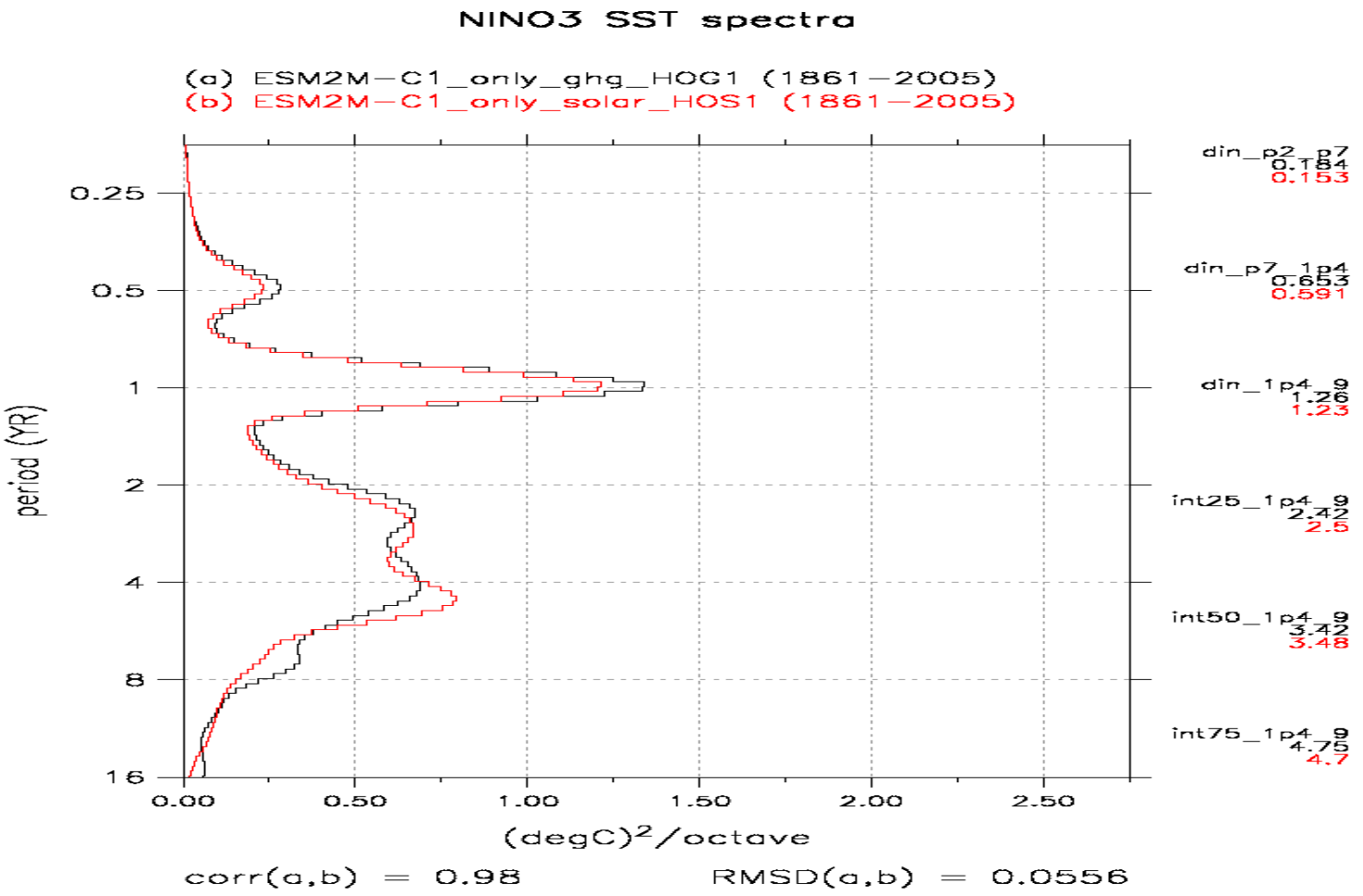
http://esgdata.gfdl.noaa.gov/thredds/dodsC/cmip5.output1.NOAA-GFDL.GFDL-ESM2M.esmrcp85.mon.atmos.Amon.r1i1p1.ts.20111228.aggregation.1

name	title	I	J	K	L
TS	Surface Temperature	1:144	1:90	...	1:1140


FERRET Ver. 6.725
NOAA/PMEL TMAP
18-JUL-2012 15:12:58
LONGITUDE : 101.3W
LATITUDE : 9 1N
CALENDAR: NOLEAP
OPeNDAP URL: http://esgdata.gfdl.noaa.gov/thredds/dodsC/
DATA SET: cmip5.output1.NOAA-GFDL.GFDL-
ESM2M.esmrcp85.mon.atmos.Amon.r1i1p1.ts.20111226.aggregation.1
NOAA GFDL GFDL-ESM2M, ESM RCP8.5 (run 1) experiment output for CMIP5 AR5
305.0
303.0
301.0
299.0
297.0
K
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
Surface Temperature (K)

LAS-User-analysis Webservice Architecture




NINO3 SST spectra
(a) ESM2M-C1_only_ghg_HOC1 (1861-2005)
(b) ESM2M-C1_only_solar_HOS1 (1861-2005)
period (YR)
0.25
0.5
1
2
4
8
16
0.00
0.50
1.00
1.50
2.00
2.50
(degC)²/octave
din_p2_p7
0.184
0.153
din_p7_1p4
0.653
0.591
din_1p4_9
1.26
1.23
int25_1p4_9
2.42
2.5
int50_1p4_9
3.42
3.48
int75_1p4_9
4.75
4.7
corr(a,b) = 0.98
RMSD(a,b) = 0.0556

What did we do just now? – "BRING ANALYSIS TO DATA"

A TEMPLATE-DRIVEN APPROACH WHERE USER-DEVELOPED ANALYSES IS APPLIED TO PUBLICLY AVAILABLE **CMIP5 DATASETS** USING **LIVE ACCESS SERVERS** AND **OPeNDAP AGGREGATION URLS**, RIGHT FROM YOUR WEB BROWSER.

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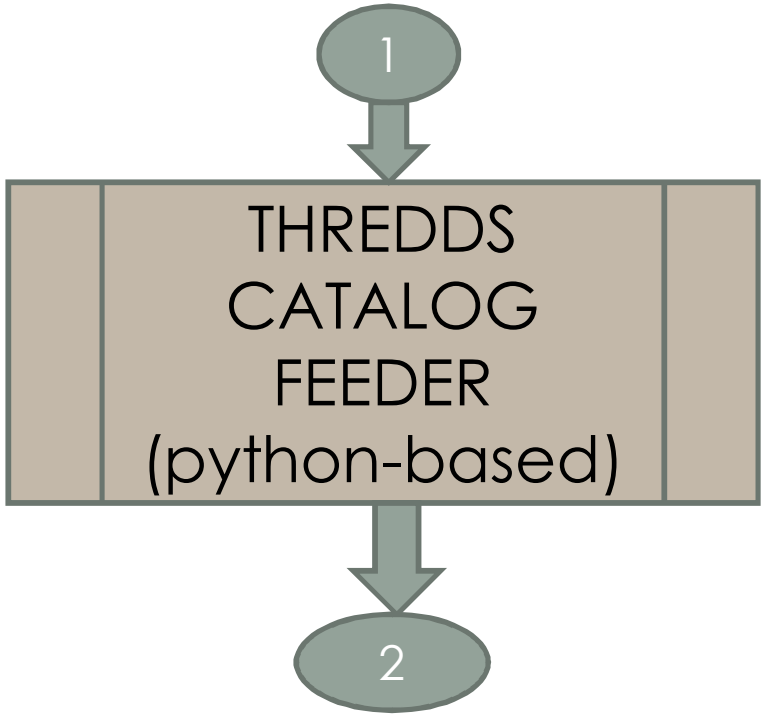
More background info:

Input: Get dataset Identifiers (D1,D2) for the experiments E1,E2 in comparison .
(This includes model-name, experiment, ensemble_member, frequency, realm, CMIP table)
Eg: NOAA-GFDL.GFDL-ESM2G.historical.mon.atmos.Amon.r1i1p1

Input: Get start_time (t_0E1,t_0E2) and end_time (t_1E1,t_1E2) for experiments E1, E2 in comparison – as input

Input: Get CMIP5 variable name (V) to be analyzed

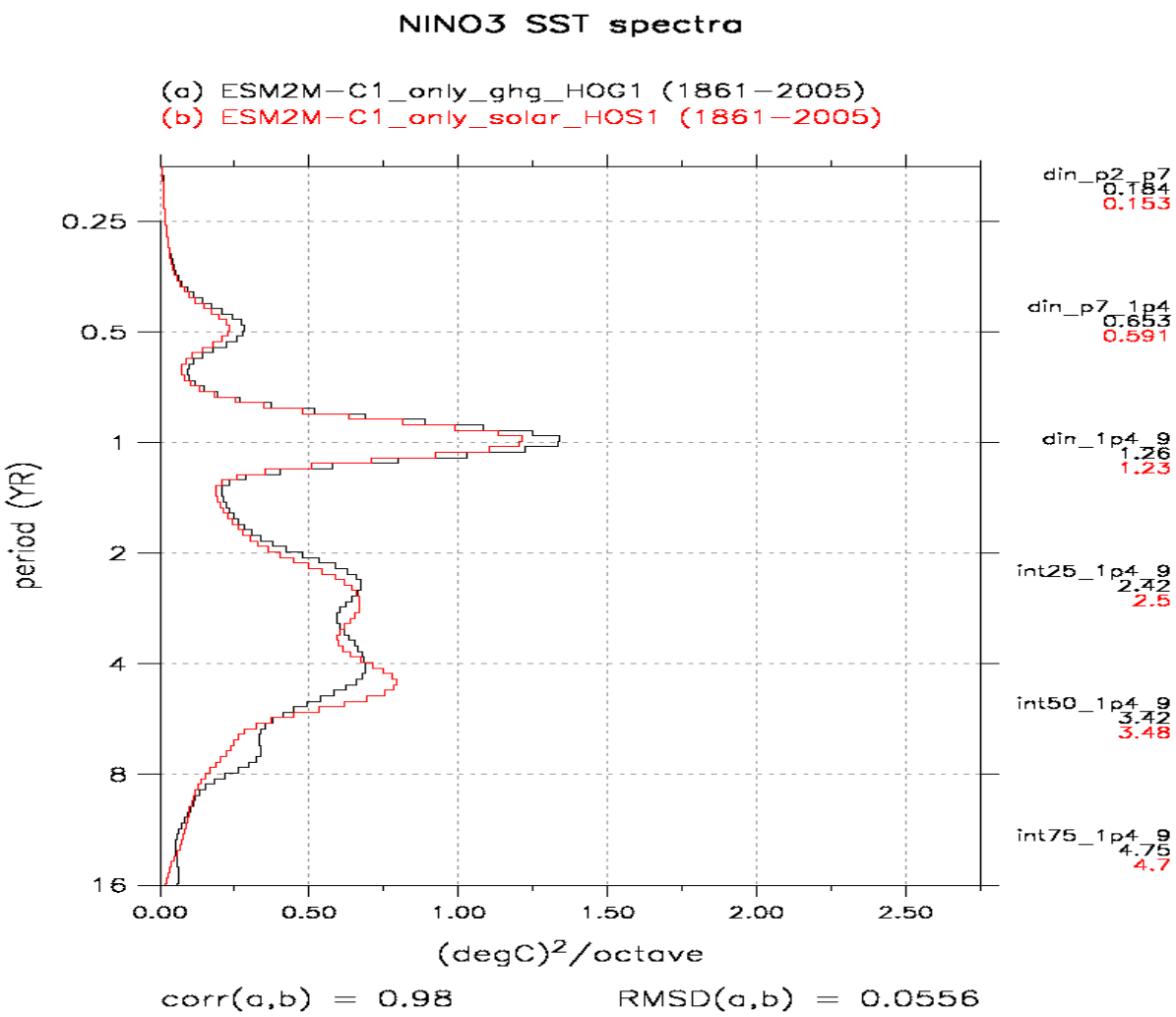
Input: Get climate analytics plot type to be applied to datasets (D1,D2)



1. Crawls through ESGF Root THREDDS catalogs and locates datasets D1,D2.
2. Fetches the OPeNDAP aggregation URL for variable "V " in datasets D1,D2.
3. Prepares arguments to be passed to the analysis script templates along with the start_time(s) (t_0E1,t_0E2) and end_time(s) (t_1E1,t_1E2).
4. Runs the analysis scripts (any language. Currently, tested with Ferret) server-side.
5. Sends analysis products back to Thredds Catalog feeder.
6. Throws exceptions if the timer ranges are not available for specified experiments or if specified variables are not part of a given experiment.

Analysis Products

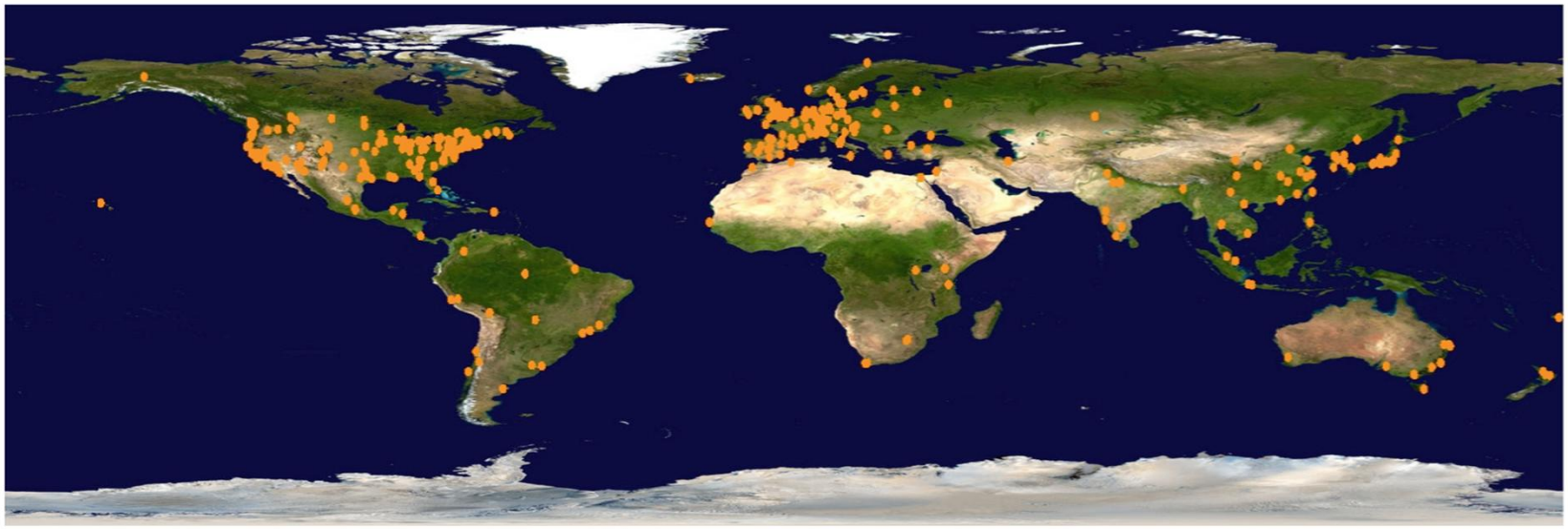
2



NetCDF files

DEMO AND CLASSWORK
Exercise -2

Please open this page for –
http://cobweb.gfdl.noaa.gov/~a1r



Thank you!

Useful References

External links-

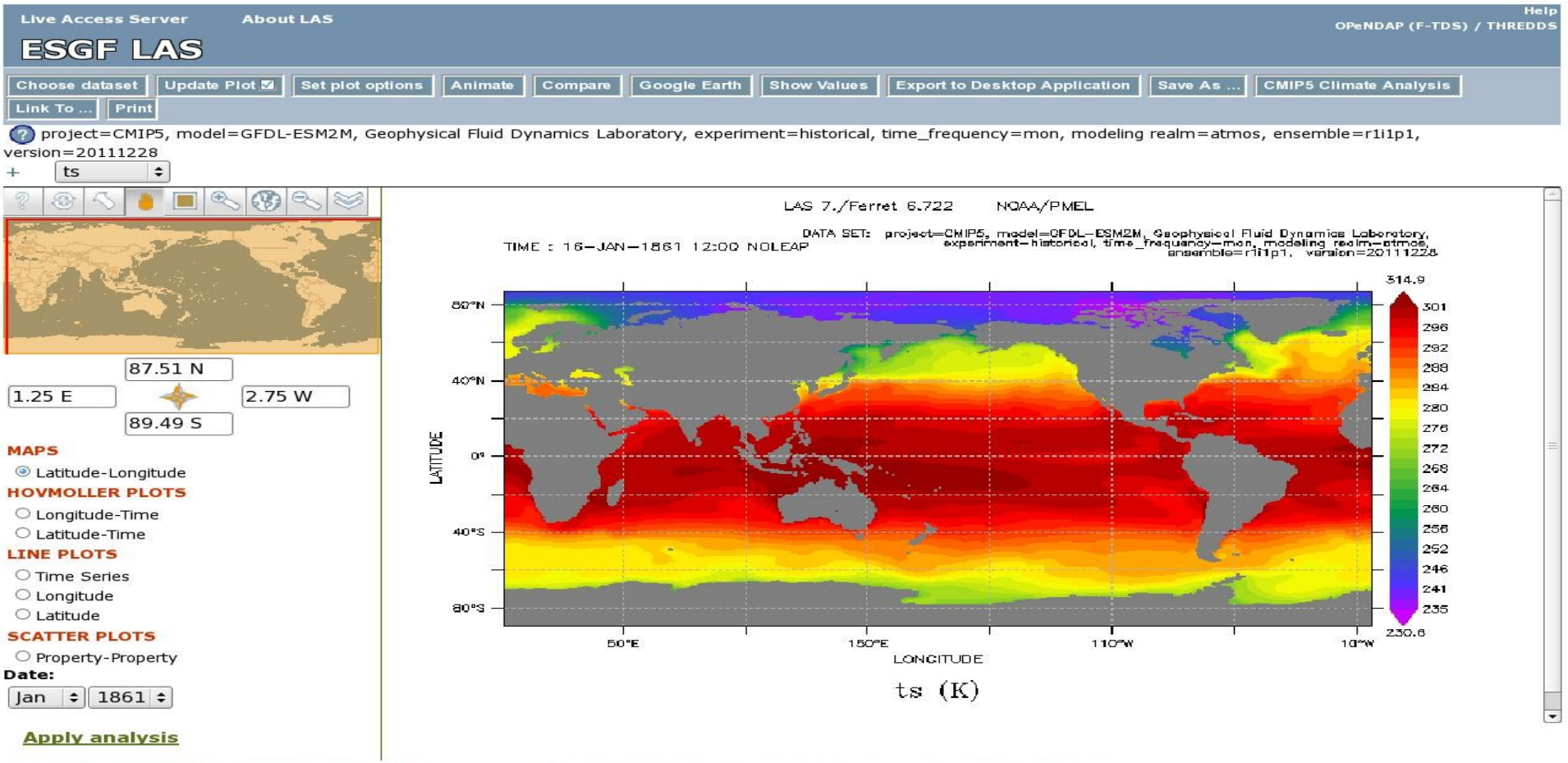
1. CMIP5 Controlled Vocabulary

http://cmip-pcmdi.llnl.gov/cmip5/output_req.html

2. IPCC AR5 - List of available variables

http://data1.gfdl.noaa.gov/nomads/forms/ipcc_var/

BACKUP SLIDES
LAS-CLIMATE ANALYSIS



Step 1: Select the data sets to be compared:

You have currently selected:

- project=CMIP5, model=GFDL-ESM2M, Geophysical Fluid Dynamics Laboratory, experiment=historical, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20111228

which will be compared to:

- project=CMIP5, model=GFDL-ESM2M, Geophysical Fluid Dynamics Laboratory, experiment=ESM historical, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20111228

Select another CMIP5 Data Set from the list below to compare with the current selection.

⊞ project=CMIP5, model=GFDL-ESM2M, Geophysical Fluid Dynamics Laboratory, experiment=ESM historical, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20111228

⊞ project=CMIP5, model=GFDL-CM3, Geophysical Fluid Dynamics Laboratory, experiment=1 percent per year CO2, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20120227

⊞ project=CMIP5, model=GFDL-CM3, Geophysical Fluid Dynamics Laboratory, experiment=abrupt 4XCO2, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20120227

⊞ project=CMIP5, model=GFDL-CM3, Geophysical Fluid Dynamics Laboratory, experiment=historical, well-mixed greenhouse gases only, time_frequency=mon, modeling realm=atmos, ensemble=r5i1p1, version=20120227

⊞ project=CMIP5, model=GFDL-ESM2G, Geophysical Fluid Dynamics Laboratory, experiment=RCP4.5, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20120412

⊞ project=CMIP5, model=GFDL-ESM2G, Geophysical Fluid Dynamics Laboratory, experiment=abrupt 4XCO2, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20120412

⊞ project=CMIP5, model=GFDL-CM3, Geophysical Fluid Dynamics Laboratory, experiment=RCP2.6, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20120227

⊞ project=CMIP5, model=GFDL-CM3, Geophysical Fluid Dynamics Laboratory, experiment=pre-industrial control, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20120227

⊞ project=CMIP5, model=GFDL-ESM2M, Geophysical Fluid Dynamics Laboratory, experiment=pre-industrial control, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20110601

⊞ project=CMIP5, model=GFDL-ESM2M, Geophysical Fluid Dynamics Laboratory, experiment=abrupt 4XCO2, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20110601

⊞ project=CMIP5, model=GFDL-ESM2G, Geophysical Fluid Dynamics Laboratory, experiment=pre-industrial control, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20120412

⊞ project=CMIP5, model=GFDL-ESM2G, Geophysical Fluid Dynamics Laboratory, experiment=historical, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20120412

⊞ project=CMIP5, model=GFDL-ESM2M, Geophysical Fluid Dynamics Laboratory, experiment=RCP4.5, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20111228

⊞ project=CMIP5, model=GFDL-HIRAM-C180, Geophysical Fluid Dynamics Laboratory, experiment=2090 time-slice, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20110601

⊞ project=CMIP5, model=GFDL-HIRAM-C360, Geophysical Fluid Dynamics Laboratory, experiment=AMIP, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20110601

⊞ project=CMIP5, model=GFDL-HIRAM-C180, Geophysical Fluid Dynamics Laboratory, experiment=AMIP, time_frequency=mon, modeling realm=atmos, ensemble=r1i1p1, version=20110601

Step 2: Select the Plot Type.

Time Averaged Spectrum

Step 3: Select the Variables and/or Regions.

☐ all ☐ Tropical Pacific ☐ Tropical Atlantic ☐ Tropical Indian

☐ ts ☐ Nino3 ☐ Nino4 ☐ Nino34 ☐ Nino12 ☐ EqAtl ☐ TNAtl ☐ TSAtl ☐ EEqIO ☐ WEqIO

☐ tauu ☐ Nino3 ☐ Nino4 ☐ WEqPac ☐ EqAtl ☐ EqIO

☐ ps ☐ Darwin ☐ Tahiti

Step 3: Select the Year Range to be compared.

Year range for the first data set.	Year range for the second data set.
Start time: 1861	Start time: 1861 Jan
End time: 1864	End time: 1865 Dec

Submit

CMIP5 Climate Analysis

experiments NOAA-GFDL.GFDL-ESM2M.historical.r1i1p1

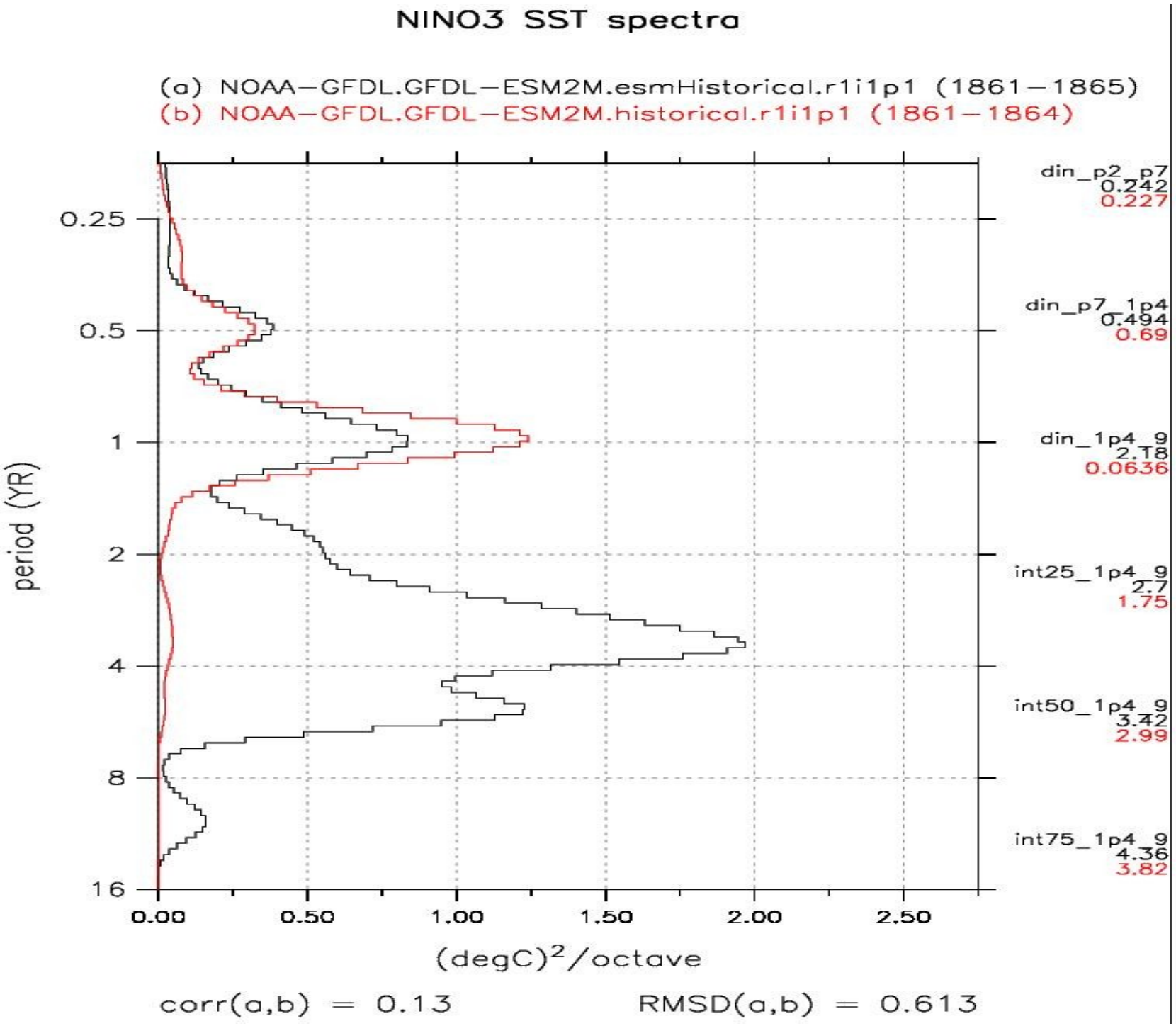
Comparing NOAA-GFDL.GFDL-ESM2M.historical.r1i1p1 vs NOAA-GFDL.GFDL-ESM2M.esmHistorical.r1i1p1

tave_spectrum wavelet 1861_1864

- **tropical_pacific**
  - ts_nino3.ps.gz

netCDF files

- ts_nino3.nc


NINO3 SST spectra
(a) NOAA-GFDL.GFDL-ESM2M.esmHistorical.r1i1p1 (1861-1865)
(b) NOAA-GFDL.GFDL-ESM2M.historical.r1i1p1 (1861-1864)
period (YR)
0.25
0.5
1
2
4
8
16
0.00
0.50
1.00
1.50
2.00
2.50
(degC)²/octave
din_p2_p7
0.242
0.227
din_p7_1p4
0.494
0.69
din_1p4_9
2.18
0.0636
int25_1p4_9
2.7
1.75
int50_1p4_9
3.42
2.99
int75_1p4_9
4.36
3.82
corr(a,b) = 0.13
RMSD(a,b) = 0.613